



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460**

March 16, 1998

**OFFICE OF
THE ADMINISTRATOR
SCIENCE ADVISORY BOARD**

Note to the Reader:

The attached draft report is a draft report of the Science Advisory Board (SAB). The draft is still undergoing final internal SAB review, however, in its present form, it represents the consensus position of the panel involved in the review. Once approved as final, the report will be transmitted to the EPA Administrator and will become available to the interested public as a final report.

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The SAB is not soliciting comments on the advice contained herein. However, as a courtesy to the EPA Program Office which is the subject of the SAB review, we have asked them to respond to the issues listed below. Consistent with SAB policy on this matter, the SAB is not obligated to address any responses which it receives.

1. Has the Committee adequately responded to the questions posed in the Charge?
2. Are any statements or responses made in the draft unclear?
3. Are there any technical errors?

For further information or to respond to the questions above, please contact:

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March 16 1998 FINAL

Draft for Subcommittee and EEC approval

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**DRAFT #5R
REPORT OF THE
ENVIRONMENTAL ENGINEERING
COMMITTEE'S
POLLUTION PREVENTION SUBCOMMITTEE
For Executive Committee Approval
by Conference Call March 31, 1998
This draft must be released to EPA & the Public
upon request**

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DRAFT

1 Date, 1997

2 EPA-SAB-EEC-97-XXX
3 Honorable Carol M. Browner
4 Administrator
5 U.S. Environmental Protection Agency
6 401 M Street, SW
7 Washington, DC 20460

8 Subject: Review of the Research Strategy for Pollution Prevention

9 Dear Ms. Browner:

10 At the request of the Office of Research and Development (ORD), the
11 Environmental Engineering Committee (EEC) of the Science Advisory Board (SAB)
12 conducted a review of the Pollution Prevention Research Strategy. The EEC's
13 Pollution Prevention Subcommittee prepared this report of the EEC's findings and
14 recommendations. In brief, the EEC was charged to comment on the strategy's
15 assessment of the current state-of-the-art and trends; the relationship of the ORD's
16 Strategic Plan to the strategy, vision, mission, and long-term goals; the scope and
17 priorities of the program; and the appropriateness of the project areas under the goals.
18 The EEC also offered some generic advice about research strategy development.

19 The Office of Research and Development (ORD) requested that the Science
20 Advisory Board (SAB) review research strategies developed by ORD research
21 coordination teams in consultation with the program offices. The Environmental
22 Engineering Committee (EEC) and a specially established multi-disciplinary
23 Subcommittee reviewed the Pollution Prevention Research Strategy at a public meeting
24 held June 30-July 3, 1997 at the National Risk Management Research Laboratory in
25 Cincinnati, Ohio. The EEC approved this report by mail ballot March 12, 1998 and the
26 Executive Committee considered the report March 31, 1998.

27 The EEC notes with pleasure ORD's progress in strategic planning. The 1996
28 ORD document, Strategic Plan for the Office of Research and Development, was
29 critical to this transition. The 1997 draft Pollution Prevention Research Strategy is one
30 of the first documents the EEC has reviewed that takes this process further.

1 The existence of a pollution prevention research strategy is, in itself,
2 commendable progress. In 1994, the EEC's strategic research planning commentary
3 (EPA-SAB-EEC-COM-94-004) recommended development of a vision statement; a
4 definition of a mission; an assessment of strengths, weaknesses, external
5 opportunities, and threats; and identification of strategic initiatives and metrics of
6 success. The EEC now recommends two advancements to the process of research
7 strategy development--the involvement of external organizations in the process and the
8 transparent documentation of decisions in the resulting research strategy.

9 The Subcommittee finds that the vision and mission statements for the research
10 strategy effectively capture the appropriate role of the ORD in pollution prevention and
11 also recognize the importance of making pollution prevention precepts and tools useful
12 to society. The strategic rationale for the ORD's program provides a clear basis for
13 delineating research priorities. The ORD considered pollution prevention needs in
14 national and internal strategies and in advice provided by advisory boards (e.g., SAB).
15 The end result of the research strategy development process appears reasonable. The
16 long-term goals developed for the research strategy are consistent with the mission
17 statement. Thus, if the long-term goals are thoroughly executed, significant advances
18 toward the stated vision will occur.

19 Goals I and II address the successful development and deployment of
20 technologies, products, tools, and methodologies targeted at high-priority health and
21 environmental problems. Goal III emphasizes ORD's role of supporting verification;
22 verification can potentially accelerate the use of pollution prevention products and
23 technologies. Goal IV recognizes that targeted social science research could foster
24 more rapid adoption of pollution prevention.

25 Implementation of the strategy is likely to produce results that will improve the
26 Agency's capacity in pollution prevention and reduce risks to human health and the
27 environment. Within the universe of research opportunities considered in the strategy,
28 the programs and projects highlighted are reasonable and largely justifiable. Strategic
29 planning for pollution prevention, however, is a dynamic process, and the strategy may
30 need revision as new information becomes available.

1 The strategy could be strengthened by documenting the decision process as
2 well as the product of those decisions. The EEC also has some concerns about how
3 the long-term goals translated into specific projects. Some of the research projects and
4 products walk a thin line between providing a useful product or service, one that would
5 not otherwise be available, and infringing on the domain of commercially viable
6 products and services. This is especially true in the area of software development.
7 Inclusion of a clear, written disclosure identifying the nature and types of technology
8 products that the ORD should or should not pursue would be invaluable as a guide.

9 Based on the Subcommittee's expertise and ORD briefings, The Subcommittee
10 concludes that the strategy is being successfully implemented. The projects being
11 undertaken in the pollution prevention field by the ORD address high-risk issues and
12 also build upon the core competencies and experiences of the ORD.

13 The Committee appreciates the opportunity to review the draft Pollution
14 Prevention Research Strategy and looks forward to a written response from the
15 Assistant Administrator of ORD.

1 Sincerely,
2 Dr. Genevieve M. Matanoski, Chair
3 Executive Committee
4 Dr. Ishwar P. Murarka, Chair (FY97)
5 Environmental Engineering Committee
6 Dr. Hilary I. Inyang, Chair (Fy98)
7 Environmental Engineering Committee
8 Dr. Calvin Chien, Chair
9 Pollution Prevention Research Strategy Subcommittee

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NOTICE

This report has been written as part of the activities of the Science Advisory Board (SAB), a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency (EPA). The Board is structured to provide balanced, expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency and, hence, the contents of this report do not necessarily represent the views and policies of the EPA nor of other agencies in the Executive Branch of the Federal government. In addition, the mention of trade names or commercial products does not constitute a recommendation for use.

ABSTRACT

At the request of the Office of Research and Development (ORD), the Environmental Engineering Committee (EEC) of the Science Advisory Board (SAB) reviewed the draft Pollution Prevention Research Strategy.

In general, implementation of the strategy is likely to produce results that will improve the Agency's capacity in pollution prevention and reduce risks to human health and the environment. The vision and mission statements for the research strategy effectively capture the appropriate role of the ORD in pollution prevention and also recognize the importance of making pollution prevention precepts and tools useful to society. The strategic rationale for the ORD's program provides a clear basis for delineating research priorities.

The programs and projects highlighted in the draft strategy are reasonable and largely justifiable. The long-term goals developed for the research strategy are consistent with the mission statement. Thus, if the long-term goals are thoroughly executed, significant advances toward the stated vision will occur.

The strategy could be strengthened by documenting the decision process as well as the product of those decisions, including the translation of long-term goals into specific projects. Some of the research projects and products walk a thin line between providing a useful product or service, one that would not otherwise be available, and infringing on the domain of commercially viable products and services. This is

1 especially true in the area of software development. Inclusion of a clear, written
2 disclosure identifying the nature and types of technology products that the ORD should
3 or should not pursue would be invaluable as a guide.

4
5 **Keywords:** pollution prevention, research strategy,

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Science Advisory Board
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June 1997

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1 EXECUTIVE SUMMARY

The EEC has commented on the substance of the draft Pollution Prevention Research Strategy and recommended generic improvements on its development.

1.1 Generic Comments on Research Strategy Development

A research strategy should document the process by which it was developed. Ideally, if all of the people involved with creating the strategy left and a new team was formed, the research strategy document would allow the new team to see not only what decisions were made, but also how and why they were made. Secondly, a research strategy should identify who is working in which areas, both inside and outside EPA. Mapping needs against what is currently being researched will identify gaps (and potential areas for collaboration). The gaps are opportunities for the EPA. Such analysis also adds credence to ORD's need for expertise in the research areas. Thirdly, the strategy should address EPA's role in the research area(s)--not just ORD's. A clarification of the EPA's role will help set the course of the overall strategy.

1.2 Specific Comments on the Draft Pollution Prevention Research Strategy

In response to the charge, the EEC finds that, overall, the draft research strategy correctly describes the current state of pollution prevention. The EEC suggests that EPA consider additional time frames. ORD can modify the current strategy to better meet short-term needs. Also, ORD could redirect the strategy so that it responds to the future needs of consistent with sustainable development paradigm.

The vision and mission statements for the research strategy are excellent. The vision statement is:

Scientifically based pollution prevention research and development products will be used routinely by communities, industries, governments, and other stakeholders for improved environmental decision making on high-risk human health and environmental problems and as part of a move toward sustainable development in the 21st century.

1 The mission statement is:

2 *To advance scientific research and develop cost-effective tools, methods,*
3 *technologies, and approaches which expand the availability and use of*
4 *pollution prevention by both the public and private sectors.*

5 The vision and mission statements clearly present the appropriate role of the
6 ORD in pollution prevention. Because the four long-term goals developed for the
7 research strategy are consistent with the mission statement, if the long-term goals are
8 thoroughly executed, significant advances toward the stated vision will occur.

9 The draft strategy recognizes the importance of making pollution prevention
10 precepts and tools useful to society. Research in this field requires more than just the
11 development of technologies to achieve progress. Relevant social, economic, and
12 behavioral factors are also important components in this process. In places, however,
13 the draft strategy emphasizes technology without fully embracing the need to integrate
14 economics, technology, social science, etc. with environmental performance.

15 The strategic rationale presented in the draft research provides a clear basis for
16 delineating research priorities. The ORD considered pollution prevention needs in
17 national and internal strategies, and in advice provided by advisory boards (including
18 the SAB). The end result appears reasonable, and until recently, this was sufficient for
19 a successful strategy. However, professional expectations for research strategy
20 development now include documentation and transparency of process. The process
21 through which the current research strategy was developed is not documented and
22 transparent; by current standards, this is a serious weakness in the strategy.

23 To improve the strategy, the EEC specifically recommends that the next attempt
24 explicitly apply relevant and mutually independent criteria in a more formal and
25 quantitative process to set priorities among potential areas of pollution prevention
26 research. Of the six criteria identified in the strategy (p.11-13), the EEC finds three to
27 be appropriate. These three are:

- 28 1. Address high-risk human health or environmental problems;
- 29 2. Respond to needs of stakeholders; and

3. Fill important research and development gaps not being addressed by others.

The EEC expects that more than three criteria will be needed to distinguish the priority of potential research areas. Other possible criteria include:

1. The probability of success;
2. Reversibility of negative impacts;
3. Impact of waiting;
4. Effectiveness of research in addressing the need; and
5. Availability of human, facility, and funding resources to meet user needs.

2 INTRODUCTION

2.1 Background to the Review

In 1996, the U.S. Environmental Protection Agency (EPA) Office of Research and Development (ORD) published its Strategic Plan for the Office of Research and Development. That plan, and the more recent 1997 Update to ORD's Strategic Plan, include two priority long-term goals addressing pollution prevention:

To provide common sense and cost-effective approaches for preventing and managing risks; and

To provide leadership and encourage others to participate in identifying emerging environmental issues, characterizing the risks associated with these issues, and developing ways of preventing or reducing these risks.

The SAB's Research Strategies Advisory Committee (RSAC) reviewed a draft of ORD's strategic plan and commented,

The general sense of RSAC was that the Plan represents a monumental undertaking and an important step forward. We congratulate ORD and EPA for producing a well-written document that responds to advice given to the Agency by other external review groups, such as the SAB and the National Academy of Sciences. The Plan clearly states the vision and mission of ORD, articulates the principles underlying EPA research, delineates long and short-term research goals, and presents criteria for priority setting. The existence of the Plan, coupled with the desire of the Agency, and specifically ORD management, to implement it, will provide ORD with much needed guidance for setting its immediate and future research agenda.

Based on these goals, the ORD formed Research Coordination Teams (RCTs) to coordinate the research program across the ORD and with ORD's clients. The RCTs are organized by media (i.e., air, waste, water, toxics/pesticides, multi-media). The RCTs developed a series of research strategies in different areas, which are being reviewed by the SAB as they become available. The research strategies elaborate on the directions in the strategic plan and provide a framework to guide investments in research and development over the next five years.

2.2 Description of the Document Reviewed

The ORD's External Review Draft: Pollution Prevention Research Strategy, May 30, 1997, characterizes state-of-the art of pollution prevention and considers where the

EPA can play a meaningful role. Based on internal and external discussions, the ORD has identified the following pollution prevention themes:

1. *Life-cycle assessment (LCA) and costing research to provide the scientific basis for comparing alternative risk management approaches.*
2. *Techniques to measure pollution prevention effectiveness and verify the performance of pollution prevention strategies.*
3. *Pollution prevention approaches for the agricultural sector.*
4. *Pollution prevention approaches to reduce greenhouse gases, including alternative energy (renewable) sources.*
5. *Pollution prevention approaches for targeted industries.*

In addition to these themes, the ORD developed the following six priority-setting criteria to drive choices in research:

1. *Address high-risk human health or environmental problems;*
2. *Respond to the needs of stakeholders;*
3. *Fill important research and development gaps not being addressed by others;*
4. *Produce multimedia solutions that have wide applicability;*
5. *Apply knowledge, experience, and capabilities that reside within the ORD; and*
6. *Leverage resources with other organizations.*

2.3 Charge for the Review

The ORD asked the EEC to comment upon the following eight questions:

1. *Is the research strategy on target in describing the current state of pollution prevention, where it should be focused in the near term, and where it needs to be directed in the future (i.e., sustainable development)?*
2. *Does the strategic review and program scoping provide a clear sense of priorities and identify the role for ORD's pollution prevention research effort? Does it support the opportunities for pollution prevention research and development described in Chapter 3.0? Have any opportunities for ORD research in pollution prevention been missed, and, if so, what are they?*
3. *Are the four long-term goals consistent with the mission of the research strategy, and, if thoroughly executed, will they effectively achieve the stated vision? If not, what improvements or changes are recommended?*
4. *Are the prioritization criteria listed in Chapter 2.0 of the research strategy thorough and will they permit rational and reasoned decision making on which projects should be pursued as part of a more detailed research and development implementation plan? If not, what needs to be done?*

- 1 5. *Are the research and development activities and project areas presented under*
2 *each of the four long-term goals generally understandable and achievable? If*
3 *not, what suggestions do you have for improvements?*
- 4 6. *Are the project areas described under Long-Term Goal II (Technologies and*
5 *Approaches) appropriate for the broad scope of the research strategy? If not,*
6 *what changes do you recommend?*
- 7 7. *Is the breadth and extent of Long-Term Goal IV (Social Science) sufficient to*
8 *advance economic, social, and behavioral issues that enhance or limit the*
9 *acceptance of pollution prevention?*
- 10 8. *Overall, does the research strategy support the position stated in the ORD*
11 *strategic plan that pollution prevention (along with new technology) is one of six*
12 *high-priority research areas that should be pursued? Is it supportive of a risk-*
13 *based approach or is a stronger argument needed?*

14 **2.4 Review Process**

15 The Environmental Engineering Committee (EEC) met June 30 through July 3,
16 1997, at the National Risk Management Research Laboratory in Cincinnati, Ohio, and
17 reviewed the Pollution Prevention Research Strategy. Dr. Calvin Chien chaired the
18 Pollution Prevention Subcommittee, and expertise was added as needed. Chapter 5 of
19 this report lists the materials reviewed. ORD briefed the EEC on the strategy, and the
20 EEC asked questions and discussed the material presented. Reviewers prepared and
21 circulated written responses to the eight charge questions at the meeting. Subsequent
22 drafts were circulated by E-mail. Both the Subcommittee and the EEC approved the
23 report by mail ballot March 12, 1998. The Executive Committee considered the
24 report at a conference call meeting, March 31, 1998.

3 RESPONSE TO THE CHARGE

Separate from its comments on the specific contents of Pollution Prevention Research Strategy, the EEC recommends that the considerations below be included in developing a research strategy.

Firstly, the strategy should document what decisions were made and how. Ideally, if all of the people involved with creating the strategy left and a new team was formed, the research strategy document should allow the new team to see not only what decisions were made, but how and why they were made. The current research strategy appears to be only an end product and does not clearly identify and quantify issues, which is a key component to setting priorities. Although some of the research areas (e.g., agriculture, global warming) may be difficult to quantify, they are extremely important and should be addressed. For example, nonpoint source discharges are a major source of water pollution, but they have not been addressed. To begin documenting the process, a comprehensive quantitative list of risks should be developed. Then, the best means to address these risks can be assessed (i.e., technology or nontechnology solutions).

Secondly, the strategy should identify who is (or should be) working in which areas, both inside and outside EPA. Mapping what needs to be done against what is currently being researched will identify gaps (and potential areas for collaboration). The gaps analysis will identify opportunities for the EPA and also contributes credence to ORD's need for expertise in the research area.

Thirdly, the strategy should address EPA's role in the various pollution prevention research areas, be it leadership or otherwise. A clarification of the EPA's role will help set the course of the overall strategy.

Fourthly, the strategy may be linked with the efforts that EPA has expended in the area of environmental management system development (such as, ISO 14000). These management principles would help improve the implementation of the strategy and make the research results more useful.

3.1 Question 1

Is the research strategy on target in describing the current state of pollution prevention, where it should be focused in the near term, and where it needs to be directed in the future (i.e., sustainable development)?

Overall, the research strategy is on target in describing the current state of pollution prevention. However, the EEC suggests both redirecting the strategy to better meet future research needs responsive to a sustainable development paradigm, and modifying the strategy to better meet short-term needs.

3.1.1 Future direction

The EPA is correct in recognizing that the future of pollution prevention is at a crossroads. Considering this situation, a more aggressive and accelerated research effort would be indicated in order to extend pollution prevention into the 21st century. From the Subcommittee's assessment, a longer-term research program that addresses sustainability development aspects has the potential of being fruitful. The EEC recommends that the EPA take an aggressive stance regarding the importance of pollution prevention in sustainable development and demonstrate how pollution prevention tools now under development can provide a path toward sustainability.

3.1.2 Short-term focus

The strategy states that "all of the low-hanging fruits have been picked." The EEC disagrees; many pollution prevention initiatives can be conducted in the near term. There are still many small and medium-sized firms and government agencies that have under-emphasized pollution prevention. The Office of Pollution Prevention and Toxics (OPPT) in EPA's Office of Prevention, Pesticides, and Toxic Substances has funded many technical assistance programs educating firms about pollution prevention. However, OPPT's programs have generally served larger firms, leaving the smallest firms in need of pollution prevention guidance. Clearly, more can be done to encourage pollution prevention in smaller industrial and governmental organizations.

Seemingly overlooked in the strategy is the recycling of mixed solid waste. Although the technology currently exists to implement technologies like recycling and composting, their full potential has not been realized.

3.1.3 Tools and initiatives

Companies taking a systems approach to pollution prevention find a variety of tools to be useful, including those for process characterization, problem solving, and decision making. These tools are common to quality management programs in these same companies. EPA should encourage the use of problem solving and decision making tools for both their internal work and in publications that are developed to help targeted industries and smaller firms seek continual improvements in their pollution prevention programs and as a path for achieving sustainability in their operations. A series of articles on these tools appeared in the journal, Pollution Prevention Review.

Identification of appropriate initiatives will be easier when EPA has improved its understanding of the research needs. The following activities may advance that understanding.

1. Stakeholder definition and polling. To determine whether the research strategy is on target, a larger set of stakeholders should be contacted to assess the needs that cannot be met with current tools. The National Pollution Prevention Roundtable and the American Institute for Pollution Prevention can help EPA identify potential stakeholders. The National Institute of Science and Technology (NIST) has 90 centers which also provide technical assistance to small and mid-sized firms and small business development centers.

Other stakeholder are citizen groups and nongovernmental organizations involved in the EPA Common Sense Initiative. Moreover, the American Institute for Pollution Prevention tracks a large number of trade and professional associations that have shown interest in pollution prevention. Finally, the Department of Defense and the Department of Energy have

active pollution prevention programs and could be potential collaborators or clients.

2. Needs analysis. One approach to strategic planning is to conduct a needs analysis by targeting a point in the future (e.g., 5 or 10 years) and determining what is required to get there. The gap between current circumstances and the point envisioned in the planning process can reveal research needs. A focus group of knowledgeable pollution prevention experts could be convened to brainstorm about the gaps and needs. Such a group should include EPA and external representatives and could be facilitated by use of the Internet.

3. Relationship between manufacturing and pollution prevention. Much research has been conducted on just-in-time source reduction (i.e., the elimination of all wastes from all business practices), agile manufacturing, manufacturing resources planning, preventive maintenance, and a variety of related topics. What was learned about source reduction and waste reduction? With some research, could some of these lessons be embraced within the pollution prevention context? What other research needs existing in these fields would further the field of pollution prevention? The EEC recommends that the EPA attempt to answer these questions during the next year while preparing the first annual update of its plan.

3.2 Question 2

Does the strategic review and program scoping (Chapter 2.0) provide a clear sense of priorities and identify the role for the ORD's pollution prevention research effort? Does it support the opportunities for pollution prevention research and development described in the Chapter 3.0 program description? Have opportunities for ORD research in pollution prevention been missed, and, if so, what are they?

3.2.1 Priorities and role

1 The strategic review and program scoping presented in the draft research
2 strategy provides a clear basis for delineating research priorities. The ORD considered
3 pollution prevention needs in national and internal strategies, and in advice provided by
4 advisory boards (including the SAB). The end result appears reasonable and until
5 recently, this was sufficient for success. However, professional expectations for
6 research strategy development now include documentation and transparency of
7 process. The process through which the current research strategy was developed is
8 not documented and transparent; by current standards, this is a weakness in the
9 strategy.

10 Section 3.4 presents and addresses criteria used to rank areas of potential
11 research. Both sections 3.2.1 and 3.4 recommend a more formal and quantitative
12 process for priority setting. Here, the EEC recommends that individual projects be
13 ranked using a balance of three criteria, called "project review critiera". These are:

- 14 1. Effectiveness of research to reduce pollution, protect human health, and
15 protect the environment, i.e., sufficiency of the research with respect to
16 meeting the needs of the users seeking to achieve source reduction and
17 protect human health and the environment;
- 18 2. Implementing capacity of the staff at the NRMRL, i.e., ability to meet user
19 needs; and
- 20 3. Resource constraints at NRMRL, i.e., ability to meet user needs

21 **3.2.2 Clarification and assumptions**

22 Sustainability is not an overall guiding principle for the strategy, but rather a goal
23 to be achieved eventually. As a result, the strategy focuses almost exclusively on
24 environmental performance and does not embrace the necessity of integrating
25 economics, technology, social science, etc. with environmental performance.

26 The introductory paragraph to the strategy defines pollution prevention not only
27 as a broad area, but one whose "...breadth...pose[s] a significant challenge." This is
28 true only if pollution prevention is considered to be something special or separate.

However, if pollution prevention is defined as those activities that achieve environmental protection by looking at causes rather than at symptoms and effects, then pollution prevention is simply a technology, and EPA has a long history of addressing technology issues.

Strategies commonly define the problem fairly early in the process. However, there is an implied problem definition toward the end of this research strategy. Leaving the definition to the interpretation of the reader is risky, and suggests that the Agency should be more precise. Hence EPA could define the problem as, "more pollution prevention technologies, and more information about pollution prevention technologies, are needed." This definition also suggests a need to address the resistance to change that may currently be a factor in the slow pace at which industry is adopting pollution prevention technologies. A more convincing case needs to be made (possibly in business terms) that a move to pollution prevention is good for business.

Therefore, the strategy may be overemphasizing development of more technology and supporting tools and underemphasizing the significance of making pollution prevention a normal part of doing business. If barriers to implementation need to be overcome, social science research may be helpful in identifying and evaluating applicable approaches.

3.2.3 Connection to priorities

The following table illustrates how EPA could relate a problem definition to the "project review criteria." To generate this table, the EEC used:

1. The problem definition suggested in Section 3.2.2, "more pollution prevention technologies, and more information about pollution prevention technologies, are needed."
2. The "project review criteria" suggested in Section 3.2.1.
3. A retrospective evaluation of the R&D activities identified (p.18-21) in the strategy.

Table 1: Retrospective Application of Project Review Criteria

	"Project review criteria " (from Section 3.2.1)		
Activities (Strategy ,p 18-21)	Effectiveness in Leading to Source Reduction	Implementing Capacity	Cost

Linking risk assessment and pollution prevention tools	Indirectly effective by providing persuasion and setting priorities.	Difficult linkage to make; many partners required.	High
Improving environmental engineering economics and cost tools	High, once in place and verified.	Good, on both sides.	Medium
Improving the utility of LCAs	Low because of limitations of the analysis.	Good for NRMRL; poor for most users.	High
Developing process simulation tools	Excellent, especially when fully integrated with other, more familiar applications.	Good on both sides.	High
Developing pollution prevention progress measurement methodologies	Marginal; mostly useful to agencies.	Low; very difficult proposition.	High
Developing impact assessment tools	Supports persuasion only.	OK for NRMRL; not for user.	Very high*
Providing decision support tools for MSW management	Minimal; heavy recycling focus.	OK	Medium
Developing improved selection tools for surface treatment	Good, although can also lead to other treatment reductions.	Excellent because of experience.	Medium

* May not be justified because it is so global

3.2.4 Missed opportunities

The EEC recommends that problem-solving tools be added for in-house research and for use by the stakeholders. The draft strategy introduces decision-making tools throughout, but problem-solving tools are not mentioned. Where problem-solving tools have the advantage is when they are used, the users are then more likely to accept the subsequent decision making. Such acceptance is generally easier when the principles are involved from the start. As a result, problem-solving tools help both the researcher and the user.

Some problem-solving tools currently in use are:

- a. Pareto analysis (rank ordering);
- b. cause and effect diagrams (root cause analysis);
- c. brainstorming; and
- d. "brainwriting" (a method of developing alternatives).

Because there is an apparent plateau in the acceptance of pollution prevention technologies by the regulated community, EPA may need to consider research in marketing and on the diffusion of technological innovations to improve the transfer of

1 their information to the “middle innovators” -- those companies that lag the early
2 innovators in the adoption of new technologies because they require more proof that
3 the change will be favorable to them. EPA may need to identify firms of this type and
4 target some for technology information and demonstration. Similar firms may then be
5 convinced to follow. Consideration should be given to the selection of industry
6 segments and the regional structure of the industry. For this approach to be
7 successful, EPA must consider altering both the means by which it transmits
8 information and its content. The focus can no longer be solely on the environmental
9 manager, and the emphasis cannot be on environmental damages and “pollution
10 prevention”. There must be a decided business tone to the information. A rationale for
11 determining the costs and benefits of improving the company’s operations should be
12 made using activity-based costing principles. Means for integrating clean technology
13 practices into core business functions need to be emphasized.

14 The EEC recommends that EPA consider P2 technology as “technology that
15 achieves environmental protection by altering causes rather than managing symptoms”.
16 These technologies may be divided into two subsets as follows:

- 17 1. Technology that improves the efficiency and effectiveness of materials
18 use enough to be considered to be commercially viable due to the
19 potential for significant cost savings; and
- 20 2. New technology that is needed to provide an answer to an unacceptable
21 release to the environment and that existing technologies provide
22 insufficient cost savings to make it commercially viable.

23 In the former case, EPA may work with technology developers as translators between
24 the regulatory and business worlds and support these technology developers by
25 providing technology verification. In the latter case, EPA may wish to take a more
26 active role in the technology development process.

27 3.2.5 Summary comments

Some industries and organizations are both pioneers and proud practitioners of pollution prevention. However, many more industries and organizations would benefit from learning that pollution prevention makes good business sense. The draft pollution prevention research strategy does not address this need.

Here is an opportunity for the NRMRL and ORD to design a persuasive educational program to promote use of pollution prevention. Such an effort may usefully combine several risk reduction options: pollution prevention technologies, economic incentives, communication, education, and environmental management systems. One approach would be to collect and describe successful pollution prevention case histories illustrating the links between: product life cycle assessment (LCA), full-cost accounting, and specific pollution prevention technologies that reduce chemical emissions. Such a program could assist companies in analyzing true environmental cost across the product life cycle, with the result that commitments to pollution prevention and sustainability might take on greater significance. Examples can be found in successful sustainability programs in European countries and associated industries.

3.3 Question 3

Are the four long-term goals consistent with the mission of the research strategy, and, if thoroughly executed, will they effectively achieve the stated vision? If not, what improvements or changes are recommended?

The vision and mission statements for the research strategy clearly articulate and emphasize sufficiently the appropriate role of the ORD in pollution prevention. The mission statement is:

To advance scientific research and develop cost-effective tools, methods, technologies, and approaches which expand the availability and use of pollution prevention by both the public and private sectors.

The vision statement is:

Scientifically based pollution prevention research and development products will be used routinely by communities, industries, governments, and other stakeholders for improved environmental decision making on

1 *high-risk human health and environmental problems and as part of a*
2 *move toward sustainable development in the 21st century.*

3 These statements recognize the importance of making pollution prevention
4 precepts and tools useful to society. They also recognize that research in this field
5 requires more than just the development of technologies to achieve progress. The
6 development of tools and methods, as well as the resolution of relevant social,
7 economic, and behavioral factors are important components of this process.

8 The four long-term goals developed for the research strategy are

9 *I. ORD will develop, test, and provide tools and methodologies which*
10 *improve individual and organizational decision making related so as to*
11 *reduce or eliminate emissions, effluents, and wastes from products,*
12 *processes, and activities.*

13 *II. ORD will develop and test pollution prevention technologies and*
14 *approaches which are applicable across economic sectors, and evaluate*
15 *products, technologies and approaches which are targetedd at preventing*
16 *high-priority human health and environmental problems in support of the*
17 *Agency's regulatory and compliance programs.*

18 *III. As part of its Environmental Technology Verification (ETV) Program,*
19 *ORD will serve as a catalyzing organization to propel into the marketplace*
20 *the most promising commercial-ready pollution prevention products and*
21 *technologies from both the public and private sectors.*

22 *IV. Through its extramural grants program, ORD will sponsor economic,*
23 *social, and behavioral research to improve decision making and foster the*
24 *adoption of pollution prevention by the public and private sectors at all*
25 *levels.*

26 These four long-term goals are consistent with the mission statement. They
27 address the successful development and deployment of technologies, products, tools,
28 and methodologies targeted at high-priority health and environmental problems (Goals
29 I and II). Additionally, the goals place the ORD in a key role of supporting verification
30 that can potentially accelerate the use of pollution prevention products and
31 technologies (Goal III). Finally, the need to conduct targeted research on social area to
32 foster more rapid adoption of pollution prevention is recognized (Goal IV).

1 Thus, if the long-term goals are thoroughly executed, significant advances
2 toward the stated vision will occur. However, the EEC has two concerns about how the
3 goals have been translated into specific projects. First, some of the research projects
4 and products walk a thin line between providing a useful product or service, one that
5 would not otherwise be available, and infringing on the domain of commercially viable
6 products and services. This is especially true in the area of software development.
7 Second, because factors such as commercialization potential, costs, and needs could
8 be used as criteria for selecting projects, the EEC recommends ORD prepare a clear,
9 written statement identifying the nature and types of technology products that the ORD
10 should or should not pursue. Such a statement will be invaluable as a guide.

11 On the whole, the definition and on-going execution of Goals I and II appear to
12 be proceeding well. However, the absence of a clear budget statement showing where
13 money is being spent to support the strategy hinders the EEC's evaluation of whether
14 resources are being appropriately applied and/or sought. Similarly, a clear delineation
15 of how each element of the strategy is addressing the identified needs would be useful
16 in understanding whether omissions in the strategy exist.

17 The EEC finds that the projects being undertaken in the pollution prevention field
18 by the ORD address high-risk issues. Additionally, the projects build upon the core
19 competencies and experiences of the ORD. The EEC finds that the Environmental
20 Technology Verification Program (ETV) is potentially very important. Therefore, at the
21 time of the meeting, the EEC was disappointed with: (a) the slow rate of progress in
22 getting the Environmental Technology Verification Program (ETV) fully underway, (b)
23 the relatively small number of technologies that have been verified to date, and (c) the
24 fact that it will be several years before the value of a verification program can be
25 determined.

26 The EEC's greatest concern is the lack of implementation of Goal IV. Activities
27 undertaken to date are not linked with the overall strategy, and there appears to be no
28 accountable plan underway to rectify this situation. The field of social and behavioral
29 research is not one of ORD's historic strengths, and specialized expertise in this area
30 will be required to appropriately define its dimensions. For this strategy to succeed,

efforts on Goal IV must be linked with the rest of the strategy. The EEC suggests that ORD develop in-house expertise on this topic, and in the meantime seek outside assistance in the social and behavioral areas to define a reasonable and useful program. Failing that, the EEC concludes that this particular goal is being given short shrift, in spite of its potential importance.

3.4 Question 4

Are the prioritization criteria listed in Chapter 2.0 of the research strategy thorough and will they permit rational and reasoned decision making on which projects should be pursued as part of a more detailed research and development plan? If not, what needs to be done?

The six prioritization criteria listed in Chapter 2.0 of the research strategy are:

1. Addresses high-risk human health or environmental problems;
2. Responds to needs of stakeholders;
3. Fills important research and development gaps not being addressed by others;
4. Produces multimedia solutions that have wide applicability;
5. Applies knowledge, experience, and capabilities that reside within the ORD;
6. Leverages resources with other organizations.

These six criteria are not thorough and by themselves they are inadequate for rational and reasoned decision making. The criteria are discussed below.

1. Addresses high-risk human health or environmental problems.
This criterion is proper because it is consistent with EPA's mission, the ORD strategy, and NRMRL's mission. To be fully defensible, the implementation of this criterion must be transparent and documented.
2. Responds to needs of stakeholders.
This criterion is proper and can be implemented by identifying and engaging the stakeholder community to catalogue their needs.

- 1 3. Fills important research and development gaps not being addressed by
2 others.

3 This criterion is proper because of EPA's mission. Currently, the strategy
4 does not document the selection of gaps to be filled. To be fully
5 defensible, the implementation of this criterion must be transparent and
6 documented. Amongst other things, a survey of the research being
7 performed by others is needed to identify gaps.

- 8 4. Produces multimedia solutions that have wide applicability.

9 The validity of this criterion is not clear because it is not independent of
10 and could conflict with the first criterion. Reducing a large risk, even in a
11 single medium, is more beneficial than reducing a smaller multi-media
12 risk. While impacting more than one medium is revealing, but not critical;
13 this criterion should not be used without cuation.

- 14 5. Applies knowledge, experience, and capabilities that reside within the
15 ORD.

16 This criterion should not be used because whether or not the ORD has
17 expertise is a management decision, not a scientific criterion.

- 18 6. Leverages resources with other organizations.

19 This criterion should not be used because it relates to implementation, not
20 to evaluation .

21 Other criteria that could be applied are:

- 22 1. The probability of success, because it is important to maximize risk
23 reduction;
24 2. The probability of promoting prevention and reducing the need for
25 "reactive" research at a later date; and
26 3. The probability that the problem will get worse if unattended for the
27 present.

28 **3.5 Question 5**

1 *Are the research and development activities and project areas presented under*
2 *each of the four long-term goals generally understandable and achievable? If*
3 *not, what suggestions do you have for improvements?*

4 The four long-term goals in the Pollution Prevention Research Strategy are:

- 5 I. Developing testing tools and methodologies
- 6 II. Developing and evaluating technologies and approaches
- 7 III. Verifying the performance of cleaner products, technologies, and
- 8 approaches
- 9 IV. Conducting research which addresses the economic, social, and
- 10 behavioral aspects of pollution prevention

11 In general, all four long-term goals address relevant areas in which the ORD
12 could potentially make a significant research contribution in pollution prevention and
13 risk management. Although each long-term goal is understandable within the general
14 context of the strategy, it is difficult to assess whether or not the ORD can achieve
15 these goals. This difficulty stems directly from the ORD's omission of a description of
16 the process used to identify and construct the four long-term goals. Understanding the
17 developmental process and the criteria used by the ORD to identify the long-term goals
18 would help determine whether or not (1) the four long-term goals are indeed the most
19 important goals for ORD to be pursuing, and (2) the ORD has identified the expertise
20 necessary for achieving each of the long-term goals. In this context, ORD should
21 review EPA's internal resources for group decision-making because use of a guided
22 process would improve transparency and documentation.

23 1. Long-Term Goal I

24 The draft strategy identified life cycle assessment (LCA), process
25 simulation and cost/benefit analysis as the primary tools for improved
26 individual and organizational pollution prevention decision making.
27 Moreover, the ORD has recognized the need to integrate these pollution
28 prevention decision-making tools with risk assessment methodologies to
29 develop decision-making approaches that include meaningful estimates of
30 the costs and benefits associated with pollution prevention options.
31

1 It is clear from the description of Long-Term Goal I that the ORD has
2 done a commendable job in identifying the technical needs required for
3 improving the pollution prevention decision-making tools. However, given
4 the uncertainty associated with the ORD's capability to identify and
5 evaluate many of the nontechnical issues impacting pollution prevention
6 decisions (e.g., social and behavioral factors, training, education),
7 achieving this goal is unlikely. It is recommended that the ORD develop a
8 rational framework, employing expertise outside of the agency, if
9 necessary, to define the nontechnical data needs that will allow a more
10 comprehensive approach to pollution prevention decision tool and
11 methodology development.

12 2. Long-Term Goal II.

13 ORD plans to develop and test pollution prevention technologies across
14 various economic sectors. It is unclear whether or not this is the most
15 cost-effective approach to develop, test, and disseminate pollution
16 prevention technologies that can reduce human health and environmental
17 risks. Major concerns are whether the ORD has the necessary in-house
18 capabilities or has developed the mechanism to acquire the necessary
19 expertise to define the process and product testing criteria and how the
20 results of such testing might be evaluated and prioritized. The EEC
21 recommends that the ORD develop a framework to identify the technical
22 and nontechnical expertise that are appropriate for pollution prevention
23 technology development and testing.

24 Based on those results, the EEC suggests that the ORD either re-define
25 the scope of Long-Term Goal II to include only those pollution prevention
26 economic sectors in which the ORD has experience or capability, or
27 develop a mechanism to acquire the needed expertise to address the
28 pollution prevention needs of a broader array of stakeholders.

29 3. Long-Term Goal III.

1 The ORD plans to focus on facilitating the transfer of the most promising
2 pollution prevention products and technologies into the marketplace. The
3 strategy did not identify the criteria the ORD will use to define a promising
4 pollution prevention technology or the metrics to be employed to gauge
5 whether a technology/product is commercially ready. Moreover, it is
6 unclear how the pollution prevention decision-making tool development
7 (Long-Term Goal I) will be integrated into the ORD's decision of what
8 constitutes a commercially ready pollution prevention alternative.

9 The EEC recommends that the ORD develop specific criteria to evaluate
10 the commercial readiness of pollution prevention products. The
11 mechanism used to develop the criteria should be well documented so
12 that the criteria can be objectively applied to a wide range of pollution
13 prevention technologies and products. Finally, the EEC suggests that the
14 ORD develop a framework to evaluate whether the Environment
15 Technology Verification Program can serve as a potential marketing tool
16 for industrial/commercial partners who choose to invest resources in this
17 program.

18 4. Long-Term Goal IV.

19 This goal represents perhaps the most difficult challenge for the ORD with
20 regard to pollution prevention program implementation. The ORD's
21 internal expertise (engineers and scientists) may be incapable of
22 formulating the correct questions that must be addressed regarding the
23 nontechnical issues critical to implementing the pollution prevention
24 program. These nontechnical issues would include, but not be limited to,
25 the social, behavioral, and cultural impediments to pollution prevention.
26 The EEC suggests that the ORD evaluate the administrative/contractual
27 options to acquire the required expertise in these nontechnical areas.
28 There is a sense of urgency since acquiring pertinent proposals in
29 pollution prevention from external organizations will require development
30 of unambiguous research criteria in the nontechnical issues impacting
31 pollution prevention.

3.6 Question 6

Are the project areas described under Long-Term Goal II (Technologies and Approaches) appropriate for the broad scope of the research strategy? If not, what changes do you recommend?

The EEC finds it difficult to map the objectives described under this goal to projects. The charge question requests commentary on the appropriateness of projects currently funded through pollution prevention, but this seems to be more of an implementation question than a strategic question. For the EEC to properly address the question, it would need to know the rationale behind the decisions, the allocation of EPA research dollars, and the process EPA uses to determine when to use the EPA or contract personnel. Absent that information, the EEC has made some assumptions and responded as follows.

3.6.1 Assumed mapping of projects to Goal II

The EEC's best understanding of mapping projects to this Goal II follows:

1. Air Pollution Prevention and Control Division
 - a. Ambient Air Pollutants; coating and cleaning operations, medium- and small-sized industries with high-risk problems
 - b. Global Climate Change; intelligent process controls, TEWI alternatives
 - c. Indoor Air Pollutants; products used indoors (consumer products and building materials)
2. University Grants Program and SBIR Program
 - a. Fundamental science research
 - b. Pre-competitive engineering research
3. Separations Technologies (projects involve sorption and membrane methods for metals and VOCs)
 - a. Pervaporation for VOC recovery and predictive software
 - b. VOC recovery from paint spray booths using Temperature Swing Adsorption (with SERDP funding)
 - c. Adsorption for metals recovery

- Low cost materials (lignins, derivitized lignins) for lead, copper, nickel, and other adsorbents for metal finishing metals
- Electrochemically enhanced adsorption
- Ion exchange membrane development, and hybrid processes for the removal of lead

4. Green engineering for chemical synthesis oxidation with photocatalysis

- a. Small-scale chemical synthesis; hydrogen from water; amino acids from methane and ammonia
- b. Detoxification of water, air; bacteria destruction

3.6.2 Tables illustrating a ranking process

The EEC prepared tables illustrating a method to rank projects for their applicability to a goal. The EEC summarized the pollution prevention research activities presented at the meeting in the first three columns of the table. The fourth column contains the results of the EEC's retrospective ranking and the last column contains the EEC's additional comments.

Upon inspection of the tables generated in this exercise, few projects ranked as highly applicable to the stated goals and objectives. A finding of this type suggests that the overall program should be re-evaluated. Also, the distinction between Objectives A and B seemed unclear, and which projects are applicable to Objective C is vague. In revising the strategy, EPA may wish to distinguish more clearly between (a) projects and strategies that satisfy long-term research goals and (b) projects that satisfy short-term program office needs. The concept of core competencies may be valuable when addressing this issue.

**Table 2A: Retrospective Ranking of Research Areas for Applicability to Goal II/
Objective A**

Research Activity Area	Project Area/ Research Activity	Program Area	Applicability to Goal II/Objective A*	Other EEC Comments
Science for pollution prevention.	Supporting fundamental research on science	Green chemistry Program / University Grants Program	High. Good program to help meet objectives	See general comment about University Grants Program
	Developing and testing improved oxidation pathways/ photocatalysis-based oxidation for chemical synthesis	Separation Technologies	Medium-Applications suggested are small-scale synthesis of H ₂ from water, and detoxification of bacteria in water. Does this really have broad enough applicability?	Not sure that applicability is broad enough to make this a pollution prevention technology. What is the relative priority of this project?
Engineering for pollution prevention.	Supporting pre-competitive engineering research	University Grants Program	High, but not sure this is best done exclusively in University Grants Program. In-house research could significantly contribute.	Be careful not to trade health and safety for pollution prevention. What is the relative priority of this task in relation to other pollution prevention tasks? How is this sub-objective different from Objective B?
Measurement, assessment, and feedback techniques for pollution prevention.	Supporting prevention-related evaluation research/LCA Systems Analysis	Systems Analysis Branch	Not obvious how it fits into this goal. But high applicability to overall goals.	Doesn't it belong under Long-Term Goal III?
	Developing intelligent controls for process operations / fuzzy logic, etc.	Global climate change	Medium. Strategic plan says this is to predict performance of intelligent controls in pollution prevention applications, thereby preventing releases and increasing energy efficiency.	Weak relation to pollution prevention. Stated objective (developing) is different from project description (predicting performance). Is this project limited to combustion applications?

* Objective A= Research, design, and assess environmentally benign industrial process and manufacturing methods

**Table 2B: Retrospective Ranking of Research Areas for Applicability to Goal II/
Objective B**

Research Activity area	Project Area/ Research Activity	Program Area (and contact)	Applicability to Goal II/ Objective B	Other EEC Comments
Metals and organics via separations technologies for in-process recycling.	Developing separations for metals / adsorption for metals recovery	Separations technologies (Harten)	High. Relevant. Allows recycle/reuse.	
	Developing membranes for organic compounds.	Separations technologies (Harten)	Low. Not clear how this would allow recycle/reuse.	Are these really P2 technologies? Seems more like treatment technologies
Global warming to reduce Total Equivalent Warming Impact (TEWI).	Investigating TEWI alternatives	Global Climate Change (Princiotta)	High. Very relevant.	
VOCs and HAPs by improving coating and cleaning operations.	Developing new and innovative coating and cleaning chemistries and equipment.	Ambient air (Princiotta)	High. Very relevant.	
	Adapting environmentally friendly coating and cleaning chemistries and equipment.	Ambient air (Princiotta)	High. Very relevant.	
Products used indoors.	Develop test methodologies & models	Indoor air	Highly applicable to overall goals. Recommend moving this project to LT Goal III.	Isn't this a tool under LT Goal III?
	Supporting research on low-emitting materials and technologies.	Indoor air (Princiotta)	High. Assume this refers to consumer products and building materials.	The description in the Strategic Plan needs clarification.

* Objective B= Develop and test technologies and approaches targeted at specific environmental problems

Table 2C: Retrospective Ranking of Research Areas for Applicability to Goal II/ Objective C

Research Activity area	Project Area/ Research Activity	Program Area	Applicability to Goal II Objective C*	Other EEC comments
Medium- and small-sized industries that pose high risk. problems	Working in the metal finishing sector.	Common Sense Initiative (CSI) & Ambient Air	Not sure exactly which projects this refers to.	
	Printing sector	CSI		
	Computer and electronics sector	CSI		
	Auto finishing sector	CSI & Program Offices (P.O.)		
	Dry-cleaning sector	Ambient Air & Multimedia Branch	High. Potential impact on P2.	This seems like it could be moved to Objective aAor B.
Support agency rule makings and initiatives that encourage P2.	Office of Water	P.O. Support	Not sure which projects this entails.	Consider taking these objectives out of this part of strategic plan.
	Office of Air and Radiation	P.O. Support		How does the budget get allocated to these tasks? Separate budget?
	Partner with other P.O.	P.O. Support		

*Objective C. Demonstrate and evaluate pollution prevention in support of Agency and Program Office priorities

3.7 Question 7

Is the breadth and extent of the Long-Term Goal IV (Social Science) sufficient to advance economic , social, and behavioral issues that enhance or limit the acceptance of pollution prevention?

Long-Term Goal IV reads: "Through its extramural grants program, ORD will sponsor economic, social, and behavioral research to improve decision making and foster the adoption of pollution prevention by the public and private sectors at all levels."

In both its written documents and in oral discussion, ORD staff have made it clear that they understand that technology development (i.e., the primary outcomes of Long-Term Goals I, II, and III) is not enough to achieve actual implementation of pollution prevention. Readily available and cost-effective pollution prevention technology enables implementation of pollution prevention. However, the vast majority of pollution prevention gain in industry and in society at large does not require improved technology but the conscious decision on the part of the participants to change their behavior and engage in certain activities, coupled with the will and resources to follow through.

With that in mind, it is hard to understand why all of the ORD's efforts oriented toward fostering pollution prevention implementation are funded through extramural grants. Extramural grants are good at advancing basic science, but rarely lead to enhanced implementation in the real world in any direct fashion. This is especially true of grants funded in concert with the National Science Foundation, with its

1 institutional bias against applications research. It is unlikely that such an approach
2 will accomplish Long-Term Goal IV, and, indeed, ORD staff have indicated that
3 proposals oriented more toward implementation issues are routinely rejected in the
4 current grants program.

5 To better understand the factors that control pollution prevention decisions,
6 ORD should develop in-house social science capability, either through professional
7 development of current staff or through hiring staff that already has the necessary
8 social science credentials. Having in-house talent will ensure that the critical role that
9 the EPA can play in pollution prevention implementation is guided by current best
10 understanding of the factors that affect decision-making behavior.

11 In the meantime, a modified extramural granting program can assist in
12 developing an understanding of the social, behavioral, and economic factors that
13 control pollution prevention decision making. The language in the requests for
14 proposal should clearly state that the efforts should be oriented towards real-world
15 implementation of pollution prevention strategies. The ORD should change its
16 strategy for social science pollution prevention research to one that is oriented toward
17 implementation. Options include managing the grants program in-house or working
18 with the NIST. These modifications to the grants program would better ensure that the
19 funded research evaluates practical obstacles to pollution prevention implementation.

20 3.8 Question 8

1 *Overall, does the research strategy support the position stated in the ORD strategic*
2 *plan that pollution prevention (along with new technology) is one of six high-priority*
3 *research areas that should be pursued? Is it supportive of a risk-based approach or is*
4 *a stronger argument needed?*

5 Some of the primary features of the ORD's plan are that it

6 1. Is founded in risk assessment principles, focusing its research and
7 development in the areas of greatest risks to people and the
8 environment.

9 2. Has strong commitments to using extramural grants and utilization of the
10 peer-review process.

11 3. Is designed to meet today's technical needs while positioning itself to aid
12 in resolving the environmental problems of tomorrow.
13

14 Of the six high-priority research needs present to support the ORD's vision,
15 mission, and long-term goals, pollution prevention and new technologies for
16 environmental protection are of paramount importance. In general, the linkages
17 between the strategy and the challenge of the sixth ORD high-priority research topic
18 on pollution prevention is clear. Furthermore, the vision statement enhances the
19 importance of the pollution prevention program, putting it in the context of the larger,
20 more long-term needs of sustainable development into the 21st century.

21 The strategy has a strong component consistent with and supportive of the risk-
22 based approach. Risks to human health and the environment can result when
23 exposure or stressors reach known toxicological or effects levels. The pollution
24 prevention program is aimed at technologies and approaches that can prevent and
25 reduce the formation and release of toxic pollutants that are of high risks to both
26 human health and the environment. In addition to developing specific exposure
27 reducing technologies (e.g., separations of metals and organic compounds in process
28 streams, alternatives to ozone-depleting chemicals, alternatives in the coatings and

1 cleaning industries to reduce VOCs and HAPs, chemicals to improve indoor air
2 quality), tools are being developed in LCA and economic analysis to better evaluate
3 the effectiveness of technology programs in reducing releases and exposure.

4.GLOSSARY

CAGE	Coatings Alternative Guide. This computerized guide was developed on an EPA contract to provide information on low emitting alternative coating technology to coatings users and technical assistance provides. It is available through the EPA Internet site - http://earth2.epa.gov/search
CSI	EPA's Common Sense Initiative. Regularly updated information on CSI can be obtained through the EPA home page in the Internet http://www.EPA.gov
EPA	U.S. Environmental Protection Agency
EEC	Environmental Engineering Committee of the EPA Science Advisory Board
ETV	EPA's Environmental Technology Verification Program
FACA	Federal Advisory Committee Act
FUZZY LOGIC	Fuzzy Logic This mathematical theory was invented in 1964 by Professor Lotfi Zadeh at UC Berkeley. Conventional logic divides the world into black and white, yes and no. Fuzzy Logic deals in shades of gray. The use of Fuzzy Logic helps computers handle artificial intelligence tasks and complex subjects.
HAPs	Hazardous Air Pollutants (Section 7 of the Clean Air Act)
LCA	Life Cycle Assessment
LONG TERM GOAL I	Developing testing tools and methodologies
LONG TERM GOAL II	Developing and evaluating technologies and approaches
LONG TERM GOAL III	Verifying the performance of cleaner products, technologies, and approaches
LONG TERM GOAL IV	Conducting research which addresses the economic, social, and behavioral aspects of pollution prevention
MISSION	To advance scientific research and develop cost-effective tools, methods, technologies, and approaches which expand the availability and use of pollution prevention by both the public and private sectors. (ORD May 1997)
NIST	National Institute of Standards and Technology
NRMRL	ORD's National Risk Management Research Laboratory

OBJECTIVES (as defined in the May 30, 1997 strategy)

For Long-Term Goal I, Objective A is, “ Develop and test user-friendly tools and methodologies for improved decision making”

For Long-Term Goal II, Objective A is, “Research, design, and assess novel and advanced environmentally benign approaches for industrial processing and manufacturing.” Objective B is, “Develop and test technologies and approaches targeted as specific environmental problems.” Objective C is, “Demonstrate and evaluate pollution prevention in support of Agency and Program Office priorities”

For Long-Term Goal III, Objective A is, “Build a high-quality and efficient program to verify the performance characteristics of pollution prevention products and technologies.”

For Long-Term Goal IV, Objective A is, “Develop and integrated social science and socioeconomic information and research products into environmental decision making.”

OPPT Office of Pollution Prevention and Toxics at the EPA

ORD Office of Research and Development at the EPA

P2 Pollution Prevention

POLLUTION PREVENTION “source reduction” (EPA) environmental sustainability including pollution prevention (National Commission on the Environment)

PRIORITY SETTING CRITERIA (In the draft strategy)

1. Addresses high-risk human health or environmental problems
2. Responds to needs of stakeholders
3. Fills important research and development gaps not being addressed by others
4. Produces multimedia solutions that have wide applicability
5. Applies knowledge, experience, and capabilities that reside within the ORD
6. Leverages resources with other organizations. (ORD May 1997)

PROGRAM OFFICES EPA regulatory offices including: the Office of Air and Radiation, the Office of Prevention, Pesticides, and Toxic Substances, and the Office of S and Emergency Response, and the Office of Water.

SAB Science Advisory Board, a FACA Committee at EPA

SAGE Solvent Alternatives Guide. This computer search tool helps solvent users and technical assistance providers find alternatives to solvents that have regulated emissions. It is available through the EPA Internet site - <http://earth2.epa.gov/search>

SBIR EPA Small Business Innovation Research Program

SERDP Strategic Environmental research and Development Program. This program is funded through the Department of Defense. Besides having the full cooperation of the U.S. EPA other agencies are also actively involved including: NIST, Department of Interior, National Institute of Health, U.S. Geological Survey and NASA.

STAR U.S. EPA Science to Achieve Results (STAR) Research Grant Program

TEWI Total Equivalent Warming Impact

VISION To advance scientific research and develop cost-effective tools, methods, technologies, and approaches which expand the availability and use of pollution prevention by both the public and private sectors. (ORD May 1997)

VOCs Volatile Organic Chemicals

6. MATERIALS REVIEWED

The following materials were available to the Environmental Engineering Committee for use in the review of the Pollution Prevention Research Strategy. They can be found in the FACA file for the June 30-July 3, 1997 Environmental Engineering Committee meeting.

1. Material for the SAB Conference Call on June 13, 1997
 - a. Agenda (1 page)
 - b. Visuals for ORD Strategy Plan (4 pages)
 - c. Visuals for Pollution Prevention Research Strategy (16 pages)
 - d. Visuals for Waste Research Strategy (13 pages)
2. Memorandum dated May 30, 1997 from the Assistant Laboratory Director of the National Risk Management Research Laboratory to Kathleen Conway
 - a. Attachment 1, Questions for the SAB on the Pollution Prevention Research Strategy
 - b. Attachment 2, Tentative Agenda for the Pollution Prevention Research Strategy Science Advisory Board Review
 - c. External Review Draft Pollution Prevention Research Strategy
 - d. Note to Kathleen Conway from Jon Herrmann?
3. 1997 Update to ORD's Strategic Plan
4. Pollution Prevention Research Strategy, SAB Briefing for the External Review Draft, June 30, 1997
Pollution Prevention Research, Sustainable Technology Division
 - a. Development and Demonstration of Cost-Effective Decision-Making Tools
 - b. Environmental Improvement Toolbox
 - c. P2P: A Measurement Methodology for Pollution Prevention Progress
 - d. A "Mark I" Measurement Methodology for Pollution Prevention Progress Occurring as a Result of Product Design Decisions

- 1 5. P2 Research Strategy Science Advisory Board Review, Preventive
- 2 Technologies and Approaches
- 3 6. Progress Tools for P2: Separations Technologies Green
- 4 Chemistry and Engineering
- 5 7. The 1997 Joint STAR Program RFAs
- 6 8. Pollution Prevention Technologies and Approaches
- 7 9. EPA's Environmental Technology Verification Program
- 8 10. 1995 U.S. EPA Science to Achieve Results (STAR) Research Grant
- 9 Awards by Selected Topics
- 10 11. EPA Small Business Innovation Research Phase I FY/97
- 11 Program Solicitation No. D700001M1
- 12 1995 ETI-SBIR Phase III
- 13 12. Pollution Prevention Status Report, Pollution Prevention
- 14 Technologies for Emissions Assessment and Management, April 1997

7. REFERENCES

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